APPENDIX B - TOBACCO RIVER WATERSHED DESCRIPTION

Table of Contents

List of Tables

List of Figures

B1.0 INTRODUCTION

This watershed description provides an overview of watershed characteristics in the Tobacco TMDL Planning Area (TPA). This section also provides some detail regarding characteristics of the watershed that may play a significant role in pollutant loading (e.g., geographical distribution of soil types, vegetative cover, or land use). The information provided herein is intended to serve as a general description of physical, climatic, hydrologic, and other ecological features within the planning area. Maps illustrating information in this watershed description are included in **Appendix A**.

B2.0 PHYSICAL CHARACTERISTICS

B2.1 LOCATION OF THE TOBACCO TMDL PLANNING AREA

The majority of the Tobacco River watershed is located in Lincoln County in northwest Montana, with a small section located in Flathead County (**Map A-1** in **Appendix A**). The watershed is located in the Upper Kootenai 4th code hydrologic unit (17010104). The Tobacco River is a fifth order watershed draining approximately 440 mi^2 (282,000 acres) between the Kootenai River on the west and the Whitefish Range on the east. The Tobacco River is located south of the United States-Canadian boarder and north of the Fisher River watershed. The Tobacco River forms at the confluence of Grave and Fortine creeks and flows into Lake Koocanusa. The Tobacco River and six of its tributaries are listed as impaired waterbodies on Montana's 2010 Water Quality Integrated Report. These tributaries include: Deep Creek, Edna Creek, Fortine Creek, Lime Creek, Swamp Creek, and Therriault Creek, and are shown in **Map A-1** in **Appendix A**.

The entire Tobacco watershed lies within the Northern Rockies Level III Ecoregion (Omernik, 1987). The Tobacco River watershed includes the following Level IV Ecoregions: Tobacco Plains, Stillwater-Swan Wooded Valley, Western Canadian Rockies and Salish Mountains (Woods et al., 2002).

B2.2 TOPOGRAPHY

The majority of the Tobacco River watershed is characterized by moderate topographic relief. Fortine Creek drains the lower two-thirds of the Tobacco River watershed. It flows north for 31 miles from its headwaters in the Salish Mountains between Davis Mountain (6,050 feet) and Elk Mountain (6,560 feet), to its confluence with Grave Creek. The average slope in the Fortine Creek 5th hydrologic unit code (HUC) watershed is approximately 20 percent (RDG, 2004). Grave Creek flows southwest for 18 miles from its headwaters in the Whitefish Range between Stahl Peak (7434 feet) and Mount Lewis (7,323 feet). The Grave Creek watershed has greater relief, with an average slope of 43 percent. The confluence of Fortine Creek and Grave Creek forms the Tobacco River, which flows an additional 13.4 miles before joining the Kootenai River at Koocanusa Reservoir near the town of Eureka, Montana. The average slope in the Lower Tobacco River watershed is approximately 20 percent. The highest point in the Lower Tobacco River watershed is 7,500 feet at Ksanka Peak in the Whitefish Range.

B2.3 CLIMATE

The Tobacco River watershed is influenced by the Aleutian low and the Pacific high pressure systems with maritime air blowing into the area on predominately westerly winds (USDA, 1998). During the

winter months, the Aleutian low dominates bringing periods of heavy precipitation. During the summer months, the Pacific high dominates, resulting in hot and dry weather. There are two long-term climate stations within the Tobacco River watershed. Their locations, elevations and periods of operation are shown in **Table B2-1** below and in **Map A-2**, found in **Attachment A**.

Table B2-1. Climate Stations within the Tobacco River Watershed, Montana

Location	**Elevation (feet)**	**Period of Operation** (as of 2006)
Eureka Ranger Station (242827)	2650	6/1/1960 to 10/31/2006
Fortine (243139)	2998	3/1/1906 to 10/31/2006

Both stations have nearly continuous data with rare, occasional dates without records. The climate stations in Eureka and Fortine are approximately 12 miles apart and are at similar elevations. The close proximity helps to explain the nearly identical patterns seen in temperature and precipitation between the two stations (**Figures B2-1**, **B2-2**, **B2-3**, and **B2- 4**).

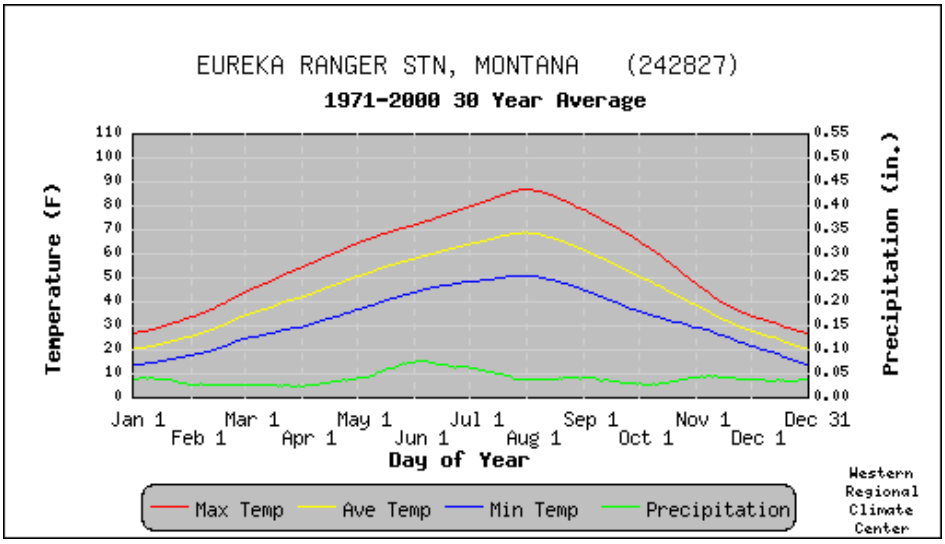

Figure B2-1. Patterns in Average Precipitation and Temperature for Eureka Ranger Station, MT (Western Regional Climate Center, 2001)

- Max. Temp. is the average of all daily maximum temperatures recorded for the day of the year between the years 1971 and 2000.
- Ave. Temp. is the average of all daily average temperatures recorded for the day of the year between the years 1971 and 2000.
- Min. Temp. is the average of all daily minimum temperatures recorded for the day of the year between the years 1971 and 2000.
- Precipitation is the average of all daily total precipitation recorded for the day of the year between the years 1971 and 2000.

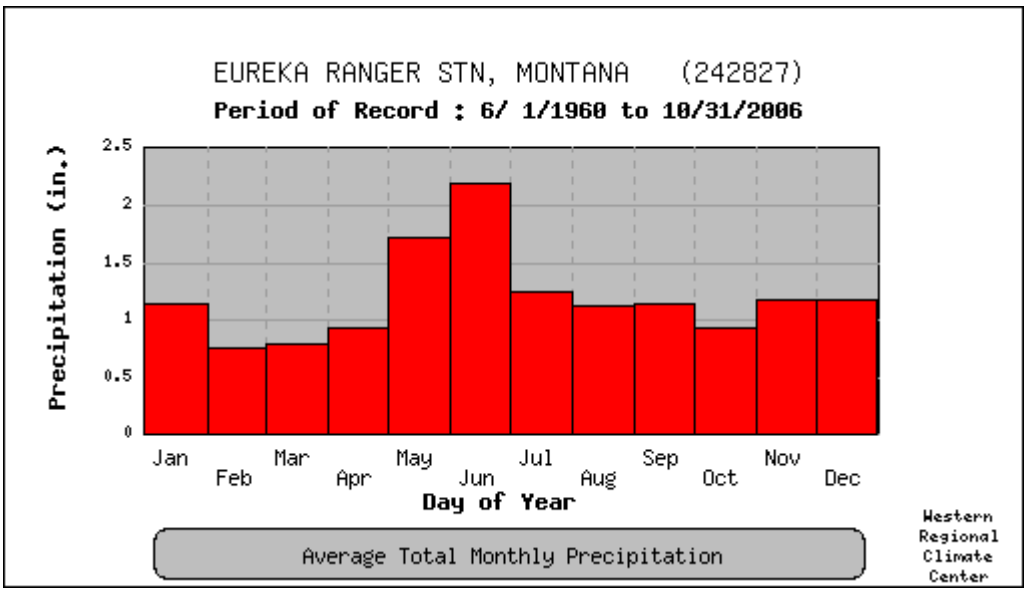

Figure B2-2. Average Total Monthly Precipitation for Eureka Ranger Station, MT (Western Regional Climate Center, 2001)

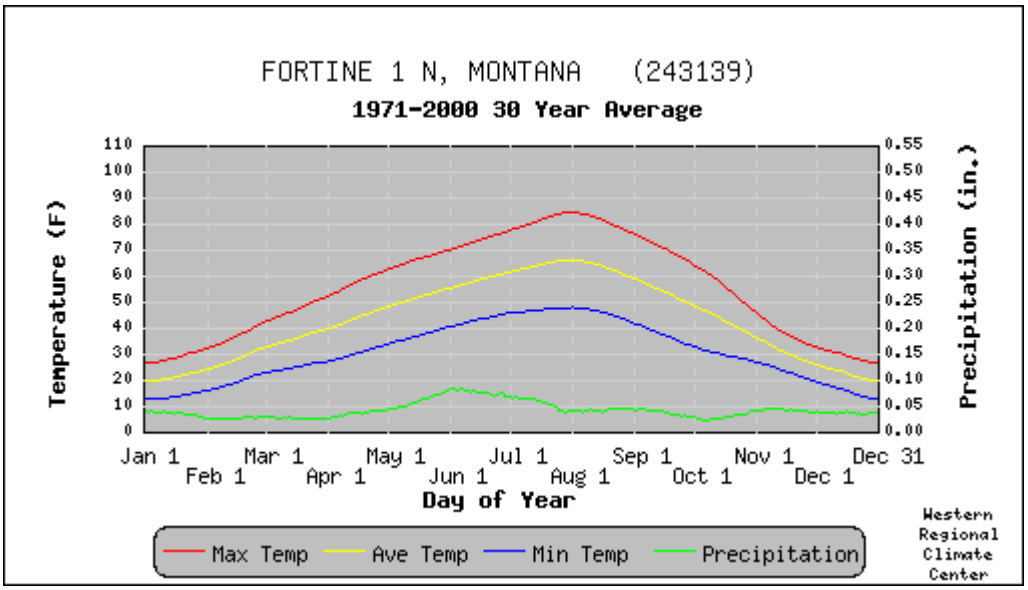

Figure B2-3. Patterns in Average Precipitation and Temperature for Fortine, MT (Western Regional Climate Center, 2001)

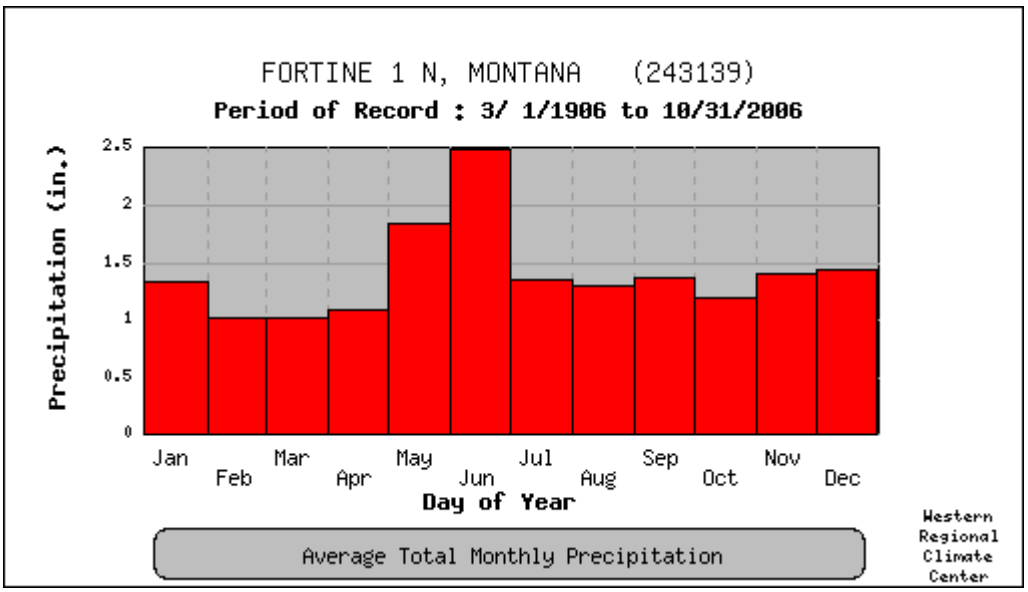

Figure B2-4. Average Total Monthly Precipitation for Fortine, MT (Western Regional Climate Center, 2001)

According to data from these stations, the Tobacco River watershed receives precipitation throughout the year with a slight peak seen in June at each station. Average total annual precipitation at the two weather stations was 15.84 inches at Fortine and 14.48 inches at Eureka (Western Regional Climate Center, 2001). These two climate stations are both located at relatively low elevations in the Tobacco Valley bottom. The Tobacco Valley is unique to this area for its mild climate. The area experiences a rain shadow effect from the Purcell Mountains to the west. Although the Purcell Mountains are relatively low at their southern end near the Tobacco Valley they apparently still present an effective barrier to some winter storms, resulting in decreased precipitation (Cooper, 2003). However, the distribution of moisture changes considerably with elevation in the Tobacco River watershed. **Map A-2** in **Appendix A** shows average annual precipitation for the entire Tobacco River watershed. This map illustrates that the precipitation in the higher elevation areas of the Whitefish Range is much greater than that recorded at the valley climate stations. This fact is also apparent when looking at data from the two SNOTEL sites located within the Tobacco River watershed (**Table B2-2**) (NRCS 1998, SNOTEL website).

Table B2-2. SNOTEL Stations within the Tobacco River Watershed, Montana

Location	ID	Elevation (feet)
Stahl Peak (787)	787	6030
Grave Creek (500)	500	4300

Both SNOTEL sites are located in the Grave Creek drainage, relatively high in the Whitefish Range. SNOTEL data has been collected continuously from these two sites since 1979. **Figure B2-5** shows the accumulated annual precipitation from 1979-2006 at the two SNOTEL sites.

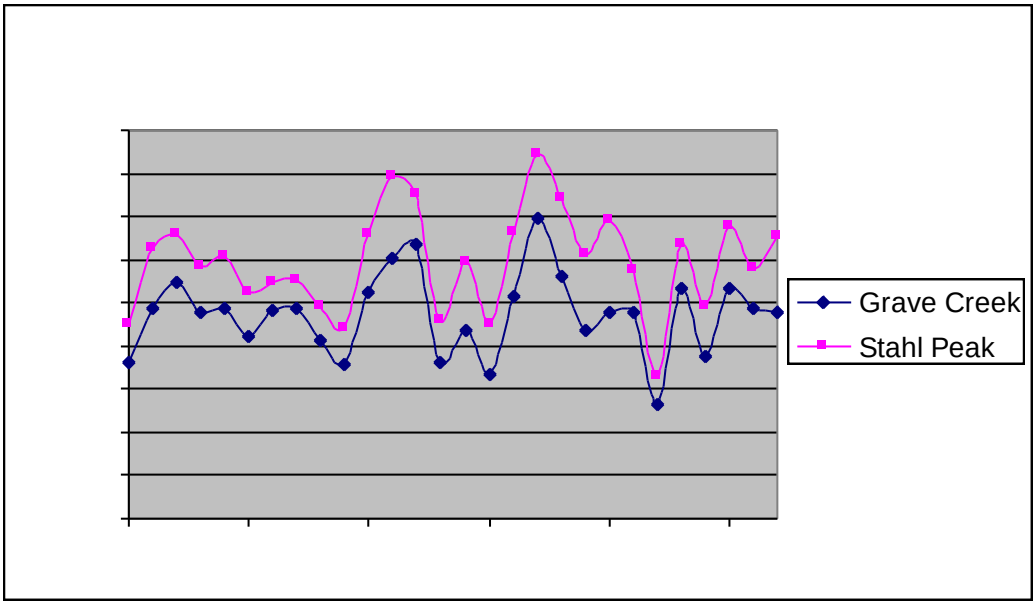

Figure B2-5. Average Accumulated Precipitation from 1979-2006 at SNOTEL Sites

This data shows much greater accumulated annual precipitation than 15-16 inches seen at the two valley bottom climate stations. The average accumulated precipitation for the years 1979-2006 was 47.3 and 59.6 inches for Grave Creek and Stahl Peak, respectively. At the Stahl Peak SNOTEL station over 84 inches of precipitation fell in the 1996 water year.

Temperatures also vary with elevation in the Tobacco River watershed. Maximum monthly average from the 1971-2000 dataset from the low elevation climate stations was 57.7°F at the Eureka Ranger Station and 55.5°F at Fortine (**Table B2-1**, **Figures B2-1** and **B2-2**). The minimum monthly average temperature was 33.0°F at Eureka and 29.1°F at Fortine. July is the hottest month of the year in the Tobacco River watershed, with an average maximum temperature of 84.9° F at Eureka and 82.4°F at Fortine. The coldest month of the year is January, with an average minimum temperature of 15.6˚F at the Eureka weather station and 11.6°F at the Fortine station. The higher elevation SNOTEL sites follow these basic trends but show average temperatures a few degrees cooler throughout the year (NRCS 1998, SNOTEL accessed 2/15/07).

B2.4 HYDROLOGY

B2.4.1 Streamflow Data

There are three USGS gaging stations located on the Tobacco River and its tributaries (**Table B2-3** below and **Map A-1** in **Appendix A**).

Table B2-3. Tobacco Watershed USGS Gaging Stations

Location	**ID**	**Dates of Operation** (as of 2006)
Tobacco River near Eureka MT	12301300	10/1958 - 9/2006
Grave Creek near Fortine, MT	12301000	4/1923 - 6/1924
Fortine Creek near Trego, MT	12300500	12/1946 - 9/1953

Data from Grave and Fortine Creeks is old and spans only a short period of time; however data from the Tobacco River station has been collected continuously since 1958. **Figure B2-6** is a hydrograph constructed from historical gage station data.

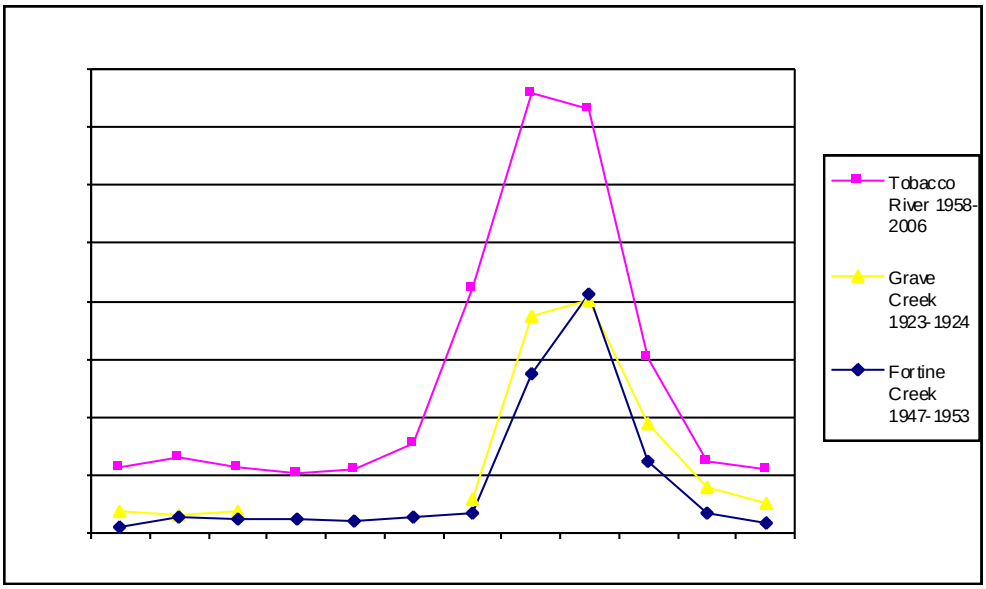

Figure B2-6. Historical Flow Data from Tobacco River watershed (USGS, accessed 2/15/07)

The data presented in **Figure B2-6** show that Fortine and Grave creeks contribute similar flows to the Tobacco River. Furthermore, all three streams peak in May or June. The data period from Grave Creek is limited to one year. For the Tobacco River, mean monthly discharge was below 150 cfs for August through February, on average over the last 50 years. Historical data indicate peak flow in May averages approximately 750 cfs. The mean historical flow does not reveal the magnitude of or variation in peak flows. As an example of the variability in flow, **Figure B2-7** illustrates daily mean discharge for 2006, which reached a peak of nearly 2,300 cfs in June.

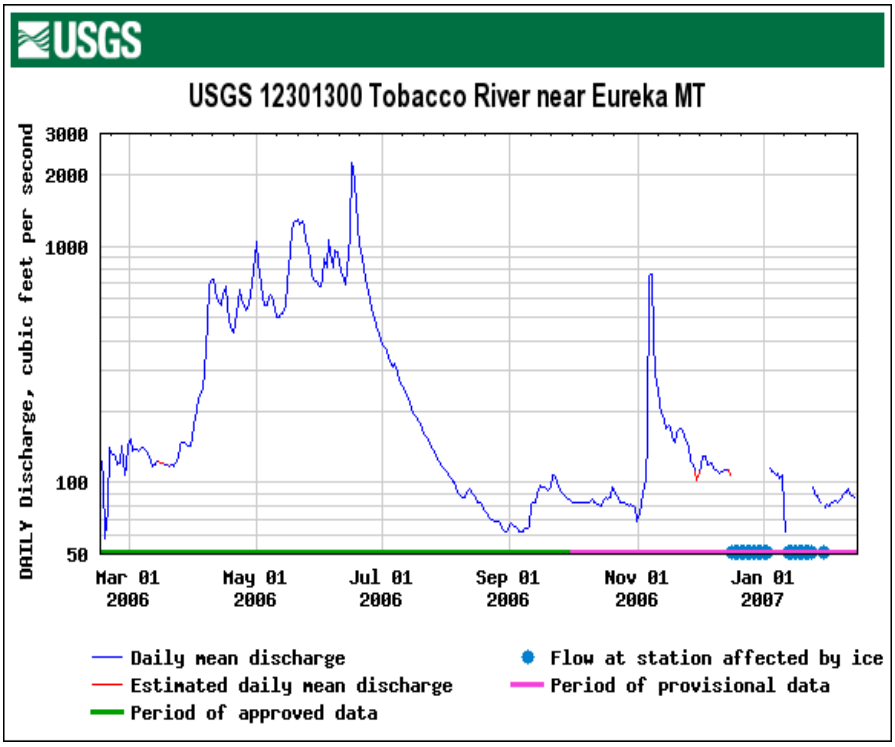

Figure B2-7. Recent Streamflow Data for Tobacco River (USGS, accessed 2/13/07)

Also worth noting in **Figure B2-7** is the peak in early November, which was caused by a rain on snow event. These events occur periodically in the Tobacco River watershed and can produce a tremendous amount of water over a short period of time (Bohn, 1998). **Figure B2-8** illustrates the range in historical peak flows on the Tobacco River at USGS gage station 12301300.

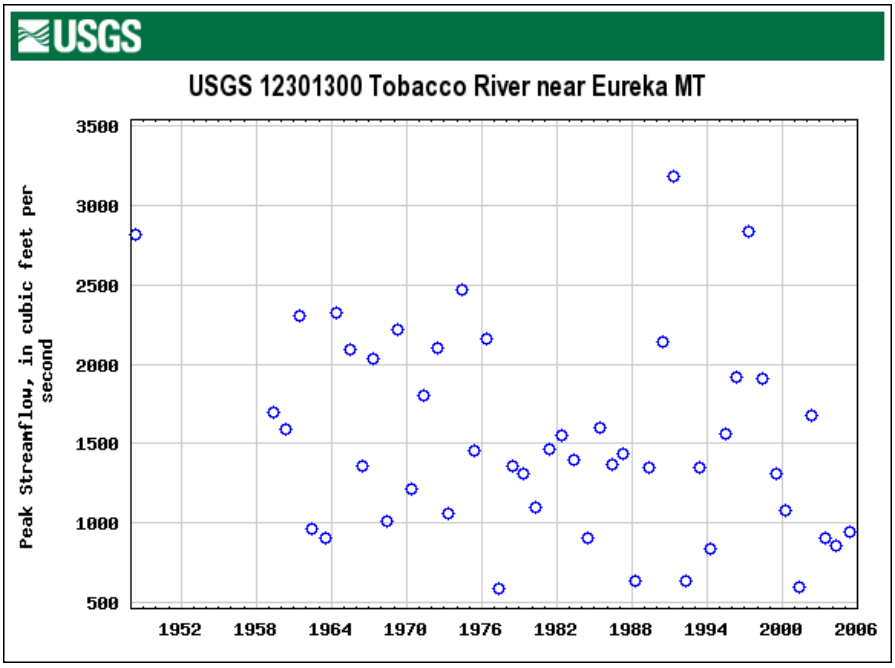

Figure B2-7. Historical peak flows for the Tobacco River (USGS, accessed 2/13/07)

These data demonstrate that the peak flow was over 2,500 cfs three times in the period of record. The highest flow on record for the Tobacco River was 3,180 cfs on May 13, 1991.

B2.4.2 Dam Information

The Tobacco River flows into Koocanusa Reservoir on the Kootenai River. Libby Dam was completed in 1972 and backs up water for 90 miles. The reservoir has some influence on fish species composition in the Tobacco River. In addition to Libby Dam, an irrigation diversion dam and head gate were installed in lower Grave Creek in 1923 (Bohn, 1998; USDA, 1999b). This structure and associated ditch provide irrigation water to the Tobacco Valley. The ditch runs over 11 miles to Eureka through Glen Lake, and is owned and operated by the Glen Lake Irrigation District. The log diversion dam had created a fish passage problem and was removed in 1999 to correct this problem (see **Section 3.5.1** for more detail) (USDA, 1999b).

B2.5 GEOLOGY, SOILS, AND MORPHOLOGY

B2.5.1 Geology

A map of the Tobacco River watershed geology is included in **Appendix A**. Most of the bedrock exposed in the area belongs to the Belt Supergroup of Precambrian age, which exceeds 40,000 feet in thickness (Johns, 1970). The rocks are composed of primarily quartzites, siltites, argillites, and dolomites (USDA, 2002). Unconsolidated Quaternary alluvium is found in the Grave Creek valley bottom, most of the lower Tobacco River, and parts of the Fortine valley bottom. The unconsolidated alluvium includes a mix of silt, sand and gravels and is highly erodible when disturbed and exposed. Small exposures of sedimentary rock of the Cambrian Period and the Devonian Period (Belt Series) are seen the Swamp Creek area of the watershed (UDSA, 1998b, Harrison, Cressman, and Wipple, 1983). The Wallace Formation, also Belt Series rock, is found in Upper Fortine, Lower Swamp, Trego, Sunday, and Upper Meadow areas. The Wallace Formation is comprised of mixed lithologies including carbonate facies, which are naturally very erodible. The Lower Swamp Creek and Fortine Creek valley bottoms are filled with unconsolidated glacial lake deposits consisting primarily of silt. Another Belt Series Group, the Piegan Group, is located in the Grave Creek and Lower Tobacco/Ksanka area. Lithologies of the Piegan group include shale and limestone (USGS, 2002).

B2.5.2 Soils

The soil types in the Tobacco River watershed are mapped by erodibility in **Map A-4** of **Appendix A**. The Tobacco Valley is filled with Pleistocene and Holocene age outwash and till. In the past 12,000 years, glaciers left large deposits of sand, silt, and rock along the floor of the Tobacco Valley; consequently, much of the plain is covered with a mantle of very fine sandy loam to loamy fine sand. Many of these deposits are relatively erodible and release much sediment when cut by streams like Fortine Creek (USDA, 1998a). Accordingly, soils in these areas have the highest erodibility (K-factor) in the watershed (**Map A-4**, **Appendix A**). Kettle holes from glacial activity occur throughout the valley.

B3.0 SOCIAL PROFILE

B3.1 LAND COVER

B3.1.1 Vegetation Types and Cover

Land cover types in the Tobacco River watershed are listed in order of dominance in **Table B3-1** below.

Table B3-1. Land Use/Cover in Tobacco River Watershed

Land Use	**Percent of Total** (as of 2006)
Evergreen Forest	74.71%
Shrubland	10.85%
Grasslands/Herbaceous	7.27%
Transitional	2.40%
Pasture/Hay	1.45%
Open Water	0.79%
Small Grains	0.63%
Fallow	0.53%
Commercial/Industrial/Transportation	0.40%
Bare Rock/Sand/Clay	0.37%
Deciduous Forest	0.31%
Emergent Herbaceous Wetlands	0.14%
Low Intensity Residential	0.08%
Woody Wetlands	0.04%
Perennial Ice/Snow	0.01%
Orchards/Vineyards/Other	0.01%
Urban/Recreational Grasses	0.00%
High Intensity Residential	0.00%
Mixed Forest	0.00%

Data Source: NRIS, from NLCD files

As listed in **Table B3-1**, the dominant vegetation in the majority of the watershed is evergreen forest (74.71%). Shrubland, the second most abundant vegetation type, is found in 10.85% of the watershed. Grassland/Herbaceous is seen in 7.27% of the Tobacco River watershed. Land cover types are also illustrated in **Map A-5** (**Appendix A**), which shows that the grass rangeland and cropland are confined to the valley bottoms and the large grassland near Eureka. Very little of the land area in the Tobacco River watershed is commercial or urban; the watershed is largely undeveloped.

Limited areas of the lower Tobacco Valley are influenced by rainshadow effects and contain remnants of true shortgrass prairie (Cooper, 2003). Looking at the precipitation map (**Map A-2** in **Appendix A**), it is clear that the valley bottoms receive significantly less precipitation than the more mountainous areas, which is reflected in the vegetation distribution. In the relatively dry (annual precipitation below 15 inches) lowland areas of the watershed (called the Tobacco Plain), mountain grassland vegetation is abundant in the form of rough fescue (Festuca campestris), Idaho fescue (Festuca idahoensis), and bluebunch wheatgrass (Pseudoroegneria spicata) (USDA, 2002; USDA, 1998a).

In the surrounding upland landscape, the annual precipitation increases and grassland changes to forested areas. The majority of the Tobacco River watershed is dominated by evergreen forests (**Table B3-**). The overall matrix for the Tobacco River watershed is a mosaic of forested types with Douglas-fir (Pseudotsuga menziesii), Western red cedar (Thuja plicata), Western hemlock (Tsuga heterophylla), and Grand fir (Abies grandis) constituting the lower elevation (montane) climax series, and subalpine fir (Abies bifolia) and spruce (Picea engelmannii) the subalpine climax series. Past disturbances such as logging and fire contribute to the abundance of subclimax forests dominated by Douglas fir, ponderosa pine, lodgepole pine (Pinus contorta) and larch (Larix occidentalis) (Cooper, 2003; Leavell, 2000; USDA, 1998b). Despite a long history of logging in the watershed, some old growth forest remains. Based on the U.S. Forest Service (USFS) Region 1 definition of old growth, subbasins of Tobacco River watershed contain the following percent cover of old growth forest: Lower Tobacco HUC, 12.5%; Fortine Creek, 6.3%; and Grave Creek, 9.5% (USDA, 2006).

B3.1.2 Riparian Habitat and Non-Native/Invasive Species

Riparian habitat on the Tobacco River has been altered by past splash dams, log drives, irrigation diversions, riparian harvest, and road and railway construction. Early settlers in the Tobacco Valley noted extensive stands of riparian vegetation containing hardwoods, conifers, willows, and alders growing alongside streams; moist draws; and wet meadows. Over the past 100 years, the riparian areas and wetlands have been eliminated, reduced, or fragmented. These areas have been drained, filled, sprayed with herbicides, grazed, or logged to facilitate agriculture and development (USDA, 1998a).

Noxious weed introduction is another element of riparian vegetation alteration. The following noxious weeds are found in the watershed: Canada Thistle (Cirsium arvense), St. Johns-Wort (Hypericum perforatum), Spotted knapweed (Centaurea maculosa), Dalmation Toadflax (Linaria dalmatica), and Sulfur Cinquefoil (Potentilla recta) (USDA, 1999a; NRIS).

B3.2 LAND OWNERSHIP

The majority (67.5%, or 298 square miles) of the land in the Tobacco River watershed is public land managed by U.S. Forest Service (**Table B3-2** below and **Map A-6** in **Appendix A**).

Table B3-2. Land Ownership Summary for the Tobacco River Watershed

Owner	Ownership (mi^2)	Percent of HUC
USFS	297.9	67.5
Private	127	28.8
State	11.3	2.6
Water	2.8	0.6
Plum Creek	1.2	0.3
The Nature Conservancy	0.9	0.2
Bureau of Reclamation	0.3	0.1

Source: NRIS, MTNHP

The USFS land is managed by the Fortine Ranger District of the Kootenai National Forest. Private land holdings account for 28.8% (127 square miles) of the land. Private land is primarily located in the valley bottoms adjacent to stream corridors. In fact, 90% of the land directly adjacent to the Tobacco River is privately owned (USDA, 1999a). Approximately three percent (11 square miles) is owned by the state of Montana. In addition, Plum Creek Timber Company, The Nature Conservancy and the U.S. Bureau of

Reclamation each own less than one percent (1.2, 0.9 and 0.3 square miles, respectively) of the land in the Tobacco River watershed. The Nature Conservancy land (Dancing Prairie Preserve) is located in the remnant prairie ecosystem just north of Eureka, Montana.

B3.3 LAND USE

B3.3.1 Timber Production

Land use in the watershed is primarily timber production, and in the past, portions of the Tobacco River watershed have been heavily logged (USDA, 1987). Homesteaders began clearing timber from their land in the Tobacco Valley in the early 1900's to meet the terms of various land acquisition acts. This cleared area was cultivated for the thriving Christmas tree market in the 1930's (USDA, 1998a). The construction of the Great Northern Railroad at the turn of the century through the Tobacco River valley established a demand for the abundant supply of timber. Widespread timber harvesting resulted in road building to facilitate harvest (USDA, 1998a).

Throughout the early 1900's Fortine Creek and the Tobacco River were used as log drive channels. Photos show large log jams completely covering the channel for long distances. Impacts of this activity are not well documented, but it can be inferred that recovery is slow and occurs on the order of 50-100 years (USDA, 1996). Early logging and subsequent fire suppression have affected the relative proportions of pine, larch and fir. Stands that were selectively harvested in the mid-1900's are now composed primarily of Douglas-fir that were left or grew in after harvest (USDA, 1998a).

B3.3.2 Agricultural Uses

Table B3-1 above and **Map A-5** in **Appendix A** show that only relatively small areas of the watershed are cultivated. Total cultivated land includes Pasture/Hay 1.45%, Small Grains 0.63%, Fallow 0.53% and Orchards/Vineyards/Other 0.01%, totaling only 2.62% of the land in the Tobacco River watershed used in agriculture.

Map A-7 in **Appendix A** shows the industrial, municipal and irrigation water withdrawals from the Tobacco River and its tributaries. Most are irrigation withdrawals (NRIS – DNRC Water Rights website). In general, irrigation withdrawals are clustered around the mouth of streams and near the towns of Fortine and Eureka. When comparing the land ownership with water withdrawal data, it was found that all irrigation withdrawals are located on private property.

B3.3.3 Recreational Activities

The Tobacco River watershed provides many opportunities for recreation, including hunting, fishing, hiking, and camping. The Kootenai National Forest supports populations of elk, moose, bighorn sheep, mountain goats, whitetail and mule deer, black and grizzly bear, and mountain lion. Many of these animals are hunted and the rivers and lakes of the watershed provide ample fishing opportunities (USDA, 1987). The Tobacco River watershed is also used by firewood and Christmas tree gatherers, mountain bikers, and horseback riders. In addition to local use, there is some commercial growth in guiding of outdoor recreation in the area.

B3.3.4 Wildfire

In the Fortine River drainage, fire scar analysis of 1995 data shows large stand replacement fires occurred infrequently in the past – only once every 150-300 years (UDSA, 1996). The natural cycle of fires has been interrupted in parts of the watershed. Fuel is accumulating in the forest and has increased

the risk of high-intensity, large acreage, stand-replacement wildfires (USDA, 1998a). According to the Forest Service the period from 1900-1950 had the largest area of fire activity in the watershed.

B3.3.5 Mining Activity

Map A-8 in **Appendix A** shows active and abandoned mines in the Tobacco River watershed. Mining played a small role in the history of the area. A gold strike in the Kootenai in 1864 led miners to move north through the area and placer mine along the Kootenai River, parts of the Tobacco River, and Grave Creek during this period (Johnson, 1950; Johns, 1970). The most productive copper-silver-lead claims are clustered in the area of Bluebird Basin, Independence Peak, and Poorman Mountain northeast of Eureka on the western slope of the Whitefish Mountain range (Johns, 1970). The Independence mine, one of the district's most important discoveries, was located in this area in 1892. The mine operated intermittently until 1912 when the British Columbia Copper Company leased it and several other claims with plans to expand and develop the mining operations. These plans were thwarted by the outbreak of World War I. Small scale mining continued in the Tobacco River district for the next several decades (Johns, 1970; Renk, 1994; Johnson, 1950). Placer deposits continued to attract prospectors, and a small amount of gold was recovered from the Tobacco River in 1921 (Lyden, 1948). High unemployment during the Depression increased the amount of placer activity throughout the region, and small strikes were made; however, no additional large scale mining operations existed.

Recent mining is limited in the Tobacco River Watershed. According to the Montana DEQ Abandoned Mines Section database there are nine lode mines and one placer mine located within the watershed. Of these most are past producers or have unknown status. The lone placer mine “Tobacco River Placer” has a listed status of expected prospect (NRIS - MTDEQ Mines Database).

B3.3.6 Transportation

Areas of high road density in the watershed are linked to the prevalence of recreational and logging activities. Transportation corridors in the Tobacco River watershed include the railroad, US highway 93, and state, county, and private roads. Burlington Northern Santa-Fe Railroad runs through the watershed and roughly parallels Highway 93.

B3.4 POPULATION

B3.4.1 Towns and Cities Located in the Watershed

The Tobacco River watershed is sparsely populated. Eureka is the largest town, with a total of 1,017 year round residents, according to the 2000 census. Other communities located within the watershed boundary include Fortine (population 200), and Trego (population 30). The population of the area is reportedly growing; the Eureka Chamber of Commerce reports a population of 5,423 in the surrounding Eureka area in 2007 (Eureka website 2007).

B3.4.2 Demographics

According to the 2000 U.S. Census Bureau data, there were approximately 4,000 people living in the Tobacco River watershed in 2000. Of these people over 97% were white (NRIS-Census Bureau Data). Information for Lincoln County suggests that the population is increasing with much of the increase attributed to retirees attracted to the outdoor beauty and affordable living of the area (USDA, 2002). In 1999, Lincoln County had a per capita personal income (PCPI) of $16,711 (the national PCPI was $28,546 at that time). Data for employment by industry shows the following top employers for Lincoln County in 1999: 24.4% Services, 17.9% Retail Trade and 16.3% Manufacturing (USDA, 2002).

B3.4.3 Septic Density/MPDES Permits and Withdrawals

According to the 2000 Census Bureau data, 98% of the Tobacco Valley watershed has low septic density (NRIS). As mentioned previously in **Section B3.3.2**, irrigation withdrawals in the watershed are concentrated on the mainstem of the Tobacco River, Grave Creek, and Fortine Creek, and at the downstream end of the tributaries (**Map A-7** in **Appendix A**). Other types of water withdrawals use-types common in the Tobacco River watershed include: Domestic use - 909 permits (31%), Stock use - 542 permits (18%), Fish and Wildlife use – 319 permits (11%) and Lawn and Garden use – 215 permits (7%). Similar to irrigation withdrawals, municipal and industrial withdrawals are located in or around the towns in the Tobacco River watershed (**Map A-7**) (NRIS – DNRC Water Rights website).

There are multiple point sources within the Tobacco River watershed with a Montana pollutant discharge elimination system general permit:

- Eureka Sewage Treatment Facility (permit number: MTG580032)
- Timberline Ready Mix (permit number: MTR300259), and
- Less than ten general permits for stormwater related to construction activities

The Eureka sewage treatment facility and the Timberline ready mix facility both discharge to the Tobacco River. The construction sites with a general stormwater permit are located throughout the watershed. The location of each permitted facility is shown on **Map A-7** in **Appendix A**.

B3.5 RESTORATIVE EFFORTS

B3.5.1 Fisheries and Aquatic Life Restoration Projects

As mentioned earlier in **Section B2.4.2**, the dam and head gate built on Grave Creek in 1923 was a major barrier to migrating bull trout. In 1976, Montana Fish Wildlife and Parks modified the diversion dam to provide passage for most fish moving upstream (USDA, 1999b); however the dam was still a partial barrier. Additionally, hydrologists determined the structure to be unstable and prone to collapse (USDA, 1999b). Glen Lake Irrigation District, the U.S. Forest Service, Montana Fish Wildlife and Parks worked out an agreement to remove the log dam and replace it with a series of rock structures. The new rock weirs are expected to improve fish passage, transport sediment bedload, and divert water for irrigation. In addition, a fish screen was installed to prevent downstream migrating fish from entering the ditch system (USFWS, 2007).

B3.5.2 Stream (Morphological, Riparian Zone) Restoration Projects

There are recent and ongoing restoration projects in the Tobacco River watershed. The Kootenai River Network (KRN) facilitates stream restoration and monitoring projects throughout the Kootenai River Basin (KRN website). On Grave Creek, approximately 1,000 feet of stream channel was reconstructed to reduce sediment delivery from a high eroding bank. The bank was re-contoured, reinforced and planted to center the streamflow, increase fisheries habitat pool habitat and complexity, and stabilize streambanks.

On Therriault Creek, approximately 9,300 feet of channel and 55 acres of abandoned wetlands adjacent to the channel were restored. These projects were planned and funded through a partnership between Bonneville Power Administration, Montana Fish Wildlife and Parks, U.S. Fish and Wildlife Service - Partners for Fish and Wildlife, Fish and Wildlife Service Private Stewardship Grant Program, Montana Future Fisheries, and the Vredenburg Ranch (KRN website).

B4.0 BIOLOGICAL RESOURCES

B4.1 FISH SPECIES FOUND IN THE TOBACCO RIVER WATERSHED

As a tributary to the Kootenai River, the Tobacco River and its tributaries provide important spawning and rearing habitat for fluvial and adfluvial fish populations that produce some of western Montana's popular sport fisheries, such as brook trout (Salvelinus fontinalis) and rainbow trout (Oncorhynchus mykiss) (Martz et al., 1988). Streams in this watershed also support species of special concern, including westslope cutthroat trout (Oncorhynchus clarkii lewisi), bull trout (Salvelinus confluentus), and Torrent sculpin (Cottus rhotheus) (**Table B4-1**).

Table B4-1. Tobacco River Watershed Fish Species of Concern

Scientific Name	Common Name	State Rank	USFW Status	USFS Status
Fish Species				
Cottus rhotheus	Torrent Sculpin	S3		
Oncorhynchus clarkii lewisi	Westslope Cutthroat Trout	S2		SENSITIVE
Salvelinus confluentus	Bull Trout	S2	THREATENED	THREATENED

Westslope cutthroat trout (Oncorhynchus clarki lewisi) is a subspecies of cutthroat trout native to Montana where it is found in the Kootenai watershed, the Clark Fork watershed, and the headwaters of the Missouri River. Westslope cutthroat trout were first described by Lewis and Clark and were once extremely abundant (Gardner, N.d.). Various studies have estimated that the westslope cutthroat trout now only occupies between 19% - 27% of its historic range in Montana (Van Eimeren, 1996). Cutthroat trout have declined due to habitat loss caused by poor grazing practices, historic logging practices, mining, agriculture, residential development, the lingering impact of forest roads, dewatering and dams. Non-native species have also taken a huge toll on westslope cutthroat trout (Novinger and Rahel, 1999). Hybridization with rainbow trout and even other non-native cutthroat trout subspecies is another reason for the decline in population. Thus, genetically pure westslope cutthroat trout are estimated to exist in only 2% - 4% of their historic stream distribution (McIntyre and Rieman, 1995).

Bull trout (Salvelinus confluentus) are listed as threatened species under the Endangered Species Act (USFWS, 1998). The bull trout is a member of the Charr family of fishes and is the only Charr species native to western Montana where populations are limited to the Columbia and Saskatchewan River basins. Bull trout are long-lived fish that do not reach breeding age until at least five years of age. Bull trout may have either a resident or migratory life history. Resident fish are usually found in smaller tributaries and headwater streams, while migratory fish spawn. The resident and migratory bull trout life history forms can live together and interbreed. This variety of life history strategies is important to the stability and persistence of populations, but complicates restoration and conservation because a diversity of high quality habitats are needed to support all life stages of bull trout. When these habitats are degraded, bull trout population may be negatively impacted (MBTRT, 2000).

In addition to habitat degradation, bull trout are threatened by non-native species hybridization and competition, historical eradication efforts, poisoning to remove non-game species, historical over-harvest, and ongoing poaching and accidental harvest due to misidentification (Meehan and Bjornn 1991, Bond 1992; Leary et al., 1993). There is a bull trout restoration plan for the state of Montana, as well as a federal recovery plan (MBTRT, 2000). Bull trout are still widely distributed, although declines in

abundance are apparent throughout the Columbia River watershed and strong or protected populations are becoming less common (Rieman et al., 1997). Bull trout redds have been observed in the Tobacco River. However, most of the bull trout from Lake Koocanusa migrate up the Tobacco River and spawn in Grave Creek and its tributaries. Most of the migrating adults and their young return to Lake Koocanusa (USDA, 1998a). Based on FWP survey information provided in the Montana Fisheries Information System (MFISH) database, abundance of Bull trout are listed as common in the Tobacco River and abundant in Grave Creek (**Tables B4-2** and **B4-3**). There is a genetically important (assumed pure) population above a fish barrier falls on Williams Creek, a tributary to Grave Creek (USDA, 1999a).

Burbot (Lota lota) is listed as a sensitive species on the Kootenai National Forest. The lower Kootenai River once supported a significant number of burbot and provided an important winter fishery. Burbot numbers have declined dramatically; this decline has been associated with habitat modification resulting from the construction and operation of Libby dam (USDA, 2002). Very little is known about burbot populations in the Tobacco River drainage; however they are thought to spawn and rear in the mouth of the Tobacco River (USDA, 1998b).

In Montana, the Torrent sculpin (Cottus rhotheus) is found only in the Kootenai River system. The Torrent sculpin is listed as a state sensitive species but is known currently to inhabit the Tobacco River and its tributaries (USDA, 1999a). Torrent sculpin require low gradient, large streams with bottom substrate that is a mix of gravel and cobbles with low to moderate surface sediment embeddedness. The construction of Lake Koocanusa probably removed important spawning habitat meeting these requirements (USDA, 1996).

Table B4-2 summarizes Montana Fisheries Information System (MFISH) data for species and their relative distribution found in the Tobacco River.

Table B4-2. Species and Relative Abundance for the Tobacco River

Species	RM 3.7-5.2	RM 5.2-6.0	RM 6.0-17.1
Brook trout	Rare (p.j.)	Rare (p.j.)	Rare (p.j.)
Bull Trout	Common (e.s.)	Common (e.s.)	Common (e.s.)
Burbot	No data	No data	No data
Largescale Sucker	Common (p.j.)	Common (p.j.)	Common (p.j.)
Longnose Dace	Common (p.j.)	Common (p.j.)	Common (p.j.)
Mountain Whitefish	Common (e.s.)	Common (e.s.)	Common (e.s.)
Rainbow Trout	Common (e.s.)	Common (e.s.)	Common (e.s.)
Sculpin	Common (p.j.)	Common (p.j.)	Common (p.j.)
Westslope Cutthroat Trout	Unknown (e.s.)	Unknown (e.s.)	Unknown (e.s.)

p.j.= professional judgment
e.s.= extrapolation from surveys
RM = River Mile
Data Source: MFWP, MFISH

Kokanee are found in the Tobacco River, and their abundance is listed as common in the MFISH database. These landlocked salmon live in Lake Koocanusa and then ascend the Tobacco River (MFISH; Books 1996). Rainbow trout are listed as common and have been historically stocked in Lake Koocanusa. As of 2006, Montana Fish Wildlife and Parks stocked approximately 45,000 rainbow trout into Lake Koocanusa (Hensler, 2007). Rainbow trout compete directly with native westslope cutthroat trout for habitat and food sources. Through hybridization, they also are a threat to genetically pure strains of

native fish (USDA, 2002). They are generally rare in the Tobacco River and Grave Creek drainages and common in some Fortine Creek drainages. Brook trout are also a concern throughout the Tobacco River watershed. FWP stocking records indicate that brook trout were first introduced into the Tobacco River in 1924 (USDA, 1999). Brook trout also compete directly with cutthroat trout. Brook trout are aggressive and highly adaptable generalists. In addition to competition for food and potential hybridization, brook trout compete with bull trout for spawning and rearing habitat (USDA, 2002). These non-native threats prevail in Fortine Creek (**Table B4-4**).

Table B4-3 summarizes MFISH data for species and their relative distribution found in Grave Creek. As mentioned above, Grave Creek is an important spawning area for the federally listed bull trout. **Table B4-4** summarizes MFISH data for species and their relative distribution found in Fortine Creek.

Table B4-3. Species and Relative Abundance for Grave Creek

Species	RM 0-9.4	RM 9.4-11.9	RM 11.9-13.2	RM 13.2-15.9
Brook trout	Rare (e.s.)	Rare (e.s.)	Rare (e.s.)	Rare (e.s.)
Bull trout	Abundant (e.s.)	Abundant (e.s.)	Abundant (e.s.)	Abundant (e.s.)
Mountain Whitefish	Common (e.s.)	Common (e.s.)	Common (e.s.)	Common (e.s.)
Rainbow Trout	Rare (e.s.)	Rare (e.s.)	Rare (e.s.)	Rare (e.s.)
Sculpin	No Data	No Data	No Data	No Data
Torrent Sculpin	Rare (p.j.)	Rare (p.j.)	Rare (p.j.)	Rare (p.j.)
Westslope Cutthroat Trout	Common (e.s.).	Common (e.s.)	Common (e.s.)	Common (e.s.)

p.j.= professional judgment
e.s.= extrapolation from surveys
RM = River Mile
Data Source: MFWP, MFISH

Table B4-4. Species and Relative Abundance for Fortine Creek

Species	RM 0-22.8	RM 22.8-26.6	RM 26.6-30.7
Brook trout	Common (e.s.)	Abundant (p.j.)	Common (p.j.)
Largescale Sucker	Rare (p.j.)	Rare (p.j.)	Rare (p.j.)
Longnose Dace	Common (p.j.)	Common (p.j.)	Common (p.j.)
Longnose Sucker	Rare (p.j.)	Rare (p.j.)	Rare (p.j.)
Mountain Whitefish	Rare (p.j.)	Rare (p.j.)	Rare (p.j.)
Rainbow Trout	Rare (p.j.)	Rare (p.j.)	Rare (p.j.)
Torrent Sculpin	Common (e.s.)	Common (e.s.)	Common (e.s.)
Westslope Cutthroat Trout	Common (p.j.)	Common (p.j.)	Common (p.j.)

p.j.= professional judgment
e.s.= extrapolation from surveys
RM = River Mile
Data Source: MFWP, MFISH

B4.2 SPECIES OF SPECIAL CONCERN

The Tobacco River watershed is home to 16 animal and 23 plant species of concern in the state of Montana's Natural Heritage Program (**Table B4-5**).

Table B4-5. Tobacco River Watershed Species of Concern

Scientific Name	Common Name	State Rank	USFW Status	USFS Status
Animal Species				
Ammodramus savannarum	Grasshopper Sparrow	S3B		
Canis lupus	Gray Wolf	S3	ENDANGERED, Experimental Population	ENDANGERED
Contopus cooperi	Olive-sided Flycatcher	S3B		
Gavia immer	Common Loon	S2B		SENSITIVE
Corynorhinus townsendii	Townsend's Big-eared Bat	S2		SENSITIVE
Histrionicus histrionicus	Harlequin Duck	S2B		SENSITIVE
Lynx canadensis	Canada Lynx	S3	THREATENED	THREATENED
Spizella breweri	Brewer's Sparrow	S2B		
Otus flammeolus	Flammulated Owl	S3B		SENSITIVE
Poecile hudsonica	Boreal Chickadee	S1S2		
Tympanuchus phasianellus columbianus	Columbian Sharp-tailed Grouse	S1		
Ursus arctos	Grizzly Bear	S2S3	THREATENED	THREATENED
Plant and Lichen species				
Botrychium ascendens	Upward-lobed Moonwort	S1S2		SENSITIVE
Botrychium crenulatum	Wavy Moonwort	S2S3		SENSITIVE
Botrychium hesperium	Western Moonwort	S2		SENSITIVE
Botrychium paradoxum	Peculiar Moonwort	S2		SENSITIVE
Botrychium pallidum	Pale Moonwort	S1		
Botrychium pedunculosum	Stalked Moonwort	S1		SENSITIVE
Brachythecium reflexum	---	S1		
Carex sychnocephala	Many-headed Sedge	S1		
Lathyrus bijugatus	Latah Tule Pea	S1		SENSITIVE
Scirpus subterminalis	Water Bulrush	S2		SENSITIVE
Silene spaldingii	Spalding's Campion	S1	THREATENED	THREATENED
Aloina brevirostris	---	S1		
Amerorchis rotundifolia	Round-leaved Orchid	S2S3		SENSITIVE
Carex prairea	Prairie Sedge	S2		SENSITIVE

Table B4-5. Tobacco River Watershed Species of Concern

Scientific Name	Common Name	State Rank	USFW Status	USFS Status
Carex vaginata	Sheathed Sedge	S1		SENSITIVE
Cypripedium passerinum	Sparrow's-egg Lady's-slipper	S2		SENSITIVE
Eleocharis rostellata	Beaked Spikerush	S2		SENSITIVE
Eriophorum gracile	Slender Cottongrass	S2		SENSITIVE
Mimulus breviflorus	Short-flowered Monkeyflower	S1S2		SENSITIVE
Mimulus patulus	Stalk-leaved Monkeyflower	S1		SENSITIVE
Ophioglossum pusillum	Adder's Tongue	S2		SENSITIVE
Scheuchzeria palustris	Pod Grass	S2		SENSITIVE
Scirpus cespitosus	Tufted Club-rush	S2		SENSITIVE
Scirpus subterminalis	Water Bulrush	S2		SENSITIVE
State Rank Scale: 1=High Risk to 5=Common Source: Montana Natural Heritage Program				

These include several of the fish species discussed above in this section and also include two threatened mammals: the Canada Lynx and the Grizzly Bear, and the endangered Gray Wolf. The Gray Wolf has recently been proposed for delisting.

B5.0 REFERENCES

Bohn, Bryce A. 1998. Watershed Analysis as a Strategy to Determine Asquatic Restoration Priorities: An Example on the Grave Creek Watershed in Northwest Montana. Fortine Ranger District, Kootenai National Forest.

Books, Dave (Editor). 1996. A Field Guide to Montana Fishes. Montana Fish Wildlife and Parks. Helena, Montana.

Bond, C. E. 1992. Notes on the nomenclature and distribution of the bull trout and the effects of human activity on the species. Pages 1-4 in P. J. Howell and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Cooper, S.V. 2003. Assessment of Kootenai National Forest Vegetation Types with Potential for Silene spaldingii in the Tobacco Plains, Rexford Bench and Salish Range Foothills. Kootenai National Forest.

EPA Ecoregions website http://www.epa.gov/wed/pages/ecoregions.htm

Eureka, Montana Chamber of Commerce website. Accessed at: www.welcome2eureka.com, on 2/14/2007.

Gardner, Beth. Status of Westslope Cutthroat Trout (Oncorhynchus clarkii lewisi) in Montana. Flathead National Forest, Swan Lake Ranger District. Bigfork, Montana. Accessed at: http://www.fisheries.org/units/AFSmontana/SSCpages /SSC.htm on 1/26/2007.

Harrison, J.E., Cressman, E.R., and Wipple J.W. 1983. “Preliminary Geology and Structure Map if Part of the Kalispell Two Degree Quadrangle, Montana,” U.S. Geological Society, Open-file report 83-502.

Hensler, Mike E. Fisheries Biologist, Montana Fish Wildlife and Parks. Personal communication, April 2007.

Johns, Willis M. 1970 "Geology and Mineral Deposits of Lincoln and Flathead Counties, Montana", Bulletin 79. Montana College of Mineral Science and Technology, Butte.

Johnson, Olga W (editor). 1950. The Story of the Tobacco Plains Country: The Autobiography of a Community. Printed for the Pioneers of the Tobacco Plains Country by Caxton Printers, Caldwell, Idaho.

Kootenai River Network website. Accessed at: http://www.kootenairivernetwork.org/index.shtml on 2/28/07.

Leary, R. F., F. W. Allendorf, S. H. Forbes. 1993. Conservation genetics of bull trout in the Columbia and Klamath River Drainages. Conservation Biology 7:856-865.

Leavell, D.M. 2000. Vegetation and process of the Kootenai National Forest. Unpublished PhD Dissertation . University of Montana, School of Forestry, Missoula, MT. 508pp.

Lyden, Charles J. 1948. The Gold Placers of Montana, Memoir No. 26. Montana. Bureau of Mines and Geology, Butte, Montana.

Martz, B., et al. 1988. Instream Flow Needs for Successful Migration and Rearing of Rainbow and Westslope Cutthroat Trout in selected Tributaries of the Kootenai River (BP-11-2). DFWP. 181 p.

McIntyre, J.D. and B.E. Rieman. 1995. Westslope Cutthroat Trout IN Conservation Assessment for Inland Cutthroat Trout. General Technical Report RM-256. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. M.K. Young, tech. Ed. Pages 1-15.

Meehan, W. R. and T. C. Bjornn. 1991. Salmonid distributions and life histories. Pages 76-78 in Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats, W. R. Meehan, Ed. American Fisheries Society Special Publication 19, Bethesda, MD

Montana Bull Trout Restoration Team (MBTRT). 2000. Restoration plan for bull trout in the Clark Fork River basin and Kootenai River basin, Montana. Montana Department of Fish, Wildlife and Parks, Helena. 116 pages.

Montana Department of Environmental Quality (MTDEQ) – Montana Pollution Discharge Elimination System (MPDES) website. Accessed at: http://www.deq.state.mt.us/wqinfo/MPDES/Index.asp on 2/28/07.

Montana Fish Wildlife and Parks. Montana Fisheries Information System (MFISH) Database Query. Accessed at: http://fwp.mt.gov/fishing/mFish/.

Montana Natural Heritage Program (MTNHP). 2003. Element Occurrence- Montana Species of Concern. Helena, Montana. Accessed at: http://nhp.nris.mt.gov/

Montana State Library. 2003. Montana Towns (based on US Census Bureau data). Helena, Montana. Accessed at http://nris.mt.gov/nsdi/nris/shape/ct107.zip

Natural Resources Conservation Services (NRCS). National Water and Climate Center. SNOTEL Website. Accessed at: http://www.wcc.nrcs.usda.gov/snotel/Montana/ montana.html on 2/14/2007.

Natural Resources Conservation Services (NRCS) Water and Climate Service. 1998. “Montana Average Annual Precipitation 1961-1990”. Oregon Climate Service at Oregon State University, Corvallis, Oregon. Accessed at: http://nris.mt.gov/nsdi/nris/shape/precip.zip

Natural Resource Information System (NRIS). Accessed at: http://nris.mt.gov.

Natural Resource Information System (NRIS). Montana Department of Environmental Quality (DEQ). Abandoned Mines from the Mine Waste Clean-up Bureau, Abandoned Mines Section database. Accessed through NRIS website: http://maps2.nris.state.mt.us/mapper/ReportsASP/AbdMine.asp. on 2/20/07.

Natural Resource Information System (NRIS). Montana Department of Natural Resources and Conservation Water Resources Division. Montana Water Rights Database. Accessed through NRIS website: http://nris.mt.gov/mapper and http://www.dnrc.mt.gov/wrd on 2/20/07.

Natural Resource Information System (NRIS). Montana Department of Environmental Quality (DEQ). Abandoned Mines from the Mine Waste Clean-up Bureau, Abandoned Mines Section database. Accessed through NRIS website: http://nris.mt.gov/dnrc/waterrights/report.aspx on 2/25/07.

Natural Resource Information System (NRIS). U.S. Census Bureau Data. Accessed at: http://maps2.nris.state.mt.us/mapper/ReportsASP/cen2000.asp and linked to http://www.census.gov/geo/www/tiger/rd_2ktiger/tgr2kweb.html on 2/25/07.

Natural Resource Information System (NRIS). Water Rights Information. Accessed at: http://nris.mt.gov/dnrc/waterrights/report on 2/26/07.

Natural Resource Information System (NRIS). Weed Distribution Information. Accessed at: http://maps2.nris.state.mt.us/mapper/ReportsASP/Weeds.asp?ProfileID. on 2/27/07.

Novinger, D.C. and F.J. Rahel. 1999. Exploring Competitive Mechanisms that Allow Non-native Brook Trout to Displace.

Omernik, J.M. 1987. Ecoregions of the conterminous United States. Map (scale 1:7,500,000). Annals of the Association of American Geographers 77(1):118-125.

Renk, Nancy F. 1994 "Mining", In Historic Overview of the Kootenai National Forest, Vol. 1, edited by Christian J. Miss. Northwest Archaeological Associates, Inc., Seattle.

Rieman, B. E., D. C. Lee and R. F. Thurow. 1997. Distribution, status and likely future trends of bull trout within the Columbia River and Klamath River basins. North American Journal of Fisheries Management 17:1111-1125.

River Design Group (RDG). 2004. Tobacco River Watershed Coarse Screen Assessment. Unpublished report located at Montana DEQ library, Helena, Montana.

Rosgen, D. L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

Thomas, G. 1992. Status report: bull trout in Montana. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Montana.

USDA. 2006. Kootenai National Forest Forest Plan, Monitoring and Evaluation Report, Fiscal Year 2005. Kootenai National Forest.

USDA. 2002. Upper Kootenai Subbasin Review. Kootenai National Forest.

USDA. 1999a. Burma/Sinclair Environmental Assessment. Fortine Ranger District, Kootenai National Forest.

USDA. 1999b. Decision Memo for Grave Creek Restoration Project. Fortine Ranger District, Kootenai National Forest.

USDA. 1998a. Meadow Environmental Impact Statement-Final EIS. Fortine Ranger District, Kootenai National Forest.

USDA. 1998b. Swamp-Edna Environmental Impact Statement (Draft). Fortine Ranger District, Kootenai National Forest.

USDA. 1996. Trego Environmental Assessment. Fortine Ranger District, Kootenai National Forest.

USDA. 1987. Final Environmental Impact Statement for the Kootenai National Forest. Northern Region Forest Service, US Department of Agriculture.

USFWS (United States Fish and Wildlife Service). 2007. Partners for Fish and Wildlife-Mountain Prairie Region Information accessed at: http://montanapartners.fws.gov /mt3a2.htm on 2/26/07.

USFWS (United States Fish and Wildlife Service). 1998. Endangered and threatened wildlife and plants; determination of threatened status for the Klamath River and Columbia River distinct population segments of bull trout. Federal Register 63:31647-31674.

U.S. Geological Survey. 2002. Shuttle Radar Topography Mission (SRTM) Elevation Data Set. The National Center for Earth Resources Observation and Science (EROS). Sioux Falls, SD. Accessed at http://seamless.usgs.gov/

U.S. Geological Survey. Water Data for the Nation. Accessed at: http://waterdata.usgs.gov/nwis/rt on 2/14/2007.

Van Eimeren, P. 1996. Westslope Cutthroat Trout Oncorhynchus clarki lewsi IN Conservation Assessment for Inland Cutthroat Trout. Distribution, Status and Habitat Management Implications. US Department of Agriculture, Forest Service, Intermountain Region, Ogden, Utah. D.A. Duff, tech. Ed. Pages 1-10.

Western Regional Climate Center (WRCC) 2001. Climate data posted at http://www.wrcc.dri.edu/summary/climsmmt.html.

Woods, Alan J., Omernik, James, M., Nesser, John A., Shelden, J., Comstock, J.A., Azevedo, Sandra H., 2002, Ecoregions of Montana, 2nd edition (color poster with map, descriptive text, summary tables, and photographs). Map scale 1:1,500,000.